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# DENATURED ALCOHOL
## AT HOME AND ABROAD

SPECIAL AND DETAILED REPORT OF THE
U.S. COMMISSIONER OF INTERNAL REVENUE (1909.
AND THE CHIEF CHEMIST OF THE BUREAU
TO THE SECRETARY OF THE TREASURY
REVIEWING OBSERVATIONS AND WORK IN
EUROPE REGARDING DENATURED ALCOHOL, ITS MANUFACTURE AND USES

FEBRUARY 5, 1909
Referred to the Committee on Ways and Means and ordered to be printed

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# LETTER OF TRANSMITTAL.

TREASURY DEPARTMENT,
*Washington, February 3, 1909.*

SIR: I have the honor to inclose herewith, for transmittal to the proper committee of the House, the special and detailed report of the Commissioner of Internal Revenue and the chief chemist of the bureau, to the Secretary of the Treasury, reviewing observations and work in Europe regarding denatured alcohol, its manufacture and uses.

Respectfully,

GEO. B. CORTELYOU,
*Secretary.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

# DENATURED ALCOHOL AT HOME AND ABROAD.

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Treasury Department,
Office of Commissioner of Internal Revenue,
*Washington, October 21, 1908.*

Sir: We have the honor to report that in compliance with your letter of instruction of June 8, 1908, as follows:

> Treasury Department, Office of the Secretary,
> *Washington, June 8, 1908.*
>
> Hon. John G. Capers,
> *Commissioner of Internal Revenue, Washington, D. C.*
>
> Sir: In order that this department may be more fully informed with respect to the latest developments and processes in foreign countries in the manufacture and utilization of denatured alcohol, you are hereby directed to visit Great Britain, Germany, and France for the purpose of studying the conditions existing in those countries and the systems used there with regard to denatured alcohol furnished for consumption in the arts and industries and for fuel, light, and power, and to make personal investigation of the regulations and modes of procedure now in force under the supervision of the countries named.
>
> Should you consider it desirable to investigate this matter further, the travel and other necessary expenses incident thereto are hereby authorized.
>
> You will please proceed under these instructions on or about July 15 and return to Washington in time to submit a report of your investigations on or before October 1, 1908.
>
> Your expenses will be paid from the appropriation for the "Withdrawal of denaturalized alcohol" for the fiscal year 1909.
>
> Respectfully,
> Geo. B. Cortelyou,
> *Secretary.*

(a similar letter having been addressed to Dr. C. A. Crampton, Chief Chemist) we proceeded to Great Britain, Belgium, France, and Germany for the purpose of investigating the various systems of government control employed in the countries of Europe for the production and use of denatured or industrial alcohol free of tax.

We sailed July 21, arrived in London July 27, and spent four days there. We then went to Paris, stopping in Brussels one day en route. We arrived in Paris August 4, and spent a week there, leaving for Berlin August 11. The remainder of the trip was devoted to Germany, Commissioner Capers having sailed on the return voyage August 25, and Chemist Crampton following September 1.

The method of procedure in each country was to secure an introduction, through our ambassador, to the officer having charge of the administration of the laws governing the collection of taxes on spirits. From this officer full information was requested concerning the laws and regulations in force providing for the use of alcohol free of tax in the arts and industries. In every case the utmost courtesy was shown us by the officials in charge, and every opportunity was given for obtaining full information concerning the subject of our inquiry. Copies of all laws, regulations, and forms were supplied, and all questions concerning the operation and effect of the laws were freely answered.

In addition to the information acquired in this way, an inspector was detailed to accompany us to denaturing or methylating establishments, distilleries, and factories where alcohol entered into the manufacturing processes, so that we could see for ourselves the actual operation of the system of control and supervision provided for by the Government.

In addition to this information, which pertains strictly to the official control, considerable time was also devoted to other phases of the subject, such as the cost of production of alcohol from various materials, the possibilities of extending its popular use, and the progress that has been made in the appliances for its utilization as a source of energy.

Much valuable assistance was rendered us in these directions by the consular officers of the various countries visited, they having good knowledge of the best sources of information of this kind through the frequent reports they have been called upon to make in previous years upon the subject of denatured alcohol.

In London, after meeting Sir Robert Chalmers, chairman of the board of inland revenue, and obtaining copies of all recent regulations and statistics in regard to the use of tax-free alcohol in Great Britain, together with his views and observations concerning the operation of existing laws there, we met the chief inspector and he assigned an inspector to duty with us for the purpose of affording us an opportunity to witness a methylating operation.

### ENGLISH SYSTEM OF METHYLATION.

The following day we accompanied the inspector to the rectifying and methylating establishments of Messrs. Boord & Sons, located on the south side of the Thames, near London Bridge. The methylating was performed in a substantial four-story brick building used solely for that purpose, and situated adjacent to but entirely separated from the rest of the establishment. The alcohol to be methylated or denatured had been shipped in bond from a molasses distillery in another part of London, and each cask was sealed by means of a strip of tin placed over the bung and sealed at each end. Two inland revenue officers had come at the appointed hour to superintend the operation, and their first act was to inspect, weigh, and gauge the alcohol and compare their figures with the gauge of the same spirits when withdrawn from the distillery for shipment. As fast as a cask was examined, it was emptied into a tank on the floor below. Then the necessary quantity of wood alcohol, and of petroleum naphtha, was run into the same tanks from the room on the top floor containing these denaturing materials, which had previously been tested by the inland revenue laboratory and found to answer the official requirements.

The contents of the methylating tanks were vigorously mixed after each addition and the quantities checked and rechecked before and after mixing. The methylated spirit was then turned over to the proprietors, and the operation completed by making the necessary records on the books of the establishment, and filling in the prescribed forms with the same information for transmission to the central office. The material tanks and room were carefully locked and sealed by the officers, who then left the establishment, the entire operation having occupied them about two hours. The necessary labor for handling the spirits and the scales and other machinery used was provided by the methylators. The vats, pipes, valves, etc., are all carefully controlled by means of locks and seals in such a manner as to provide against any possibility of misuse, and the methylating operation impressed us as being very carefully carried out, every cask being thoroughly drained, and all details of the inspection being rigorously attended to. Messrs. Boord & Sons make both kinds of methylated spirits provided for by the British regulations, viz, *industrial* and *mineralized*, the former containing 5 per cent of approved wood alcohol, and being used only by manufacturers under bond, and the latter containing 10 per cent of wood alcohol and three-eighths of 1 per cent of mineral naphtha or petroleum oil.

The industrial methylated spirits is a modification of the ordinary methylated spirits which was the one form authorized in Great Britain for industrial purposes prior to October 1, 1906, and which contained 10 per cent of wood alcohol and no mineral naphtha. The reduction from 10 to 5 per cent of wood alcohol was made as a concession to manufacturers using alcohol, and they were granted, at the same time, the payment of an allowance of 3d. per proof gallon, the same as that paid for exported British spirits, for all alcohol used in the arts and industries.

The following table shows the quantity of each kind of methylated spirits used in Great Britain during the ten years—1897–98 to 1907–8:

*Total homemade and colonial and foreign spirits.*

| Year. | England. | Scotland. | Ireland. | United Kingdom. |
|---|---|---|---|---|
| | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* |
| 1897-98 | 3,945,288 | 476,824 | 40,456 | 4,462,568 |
| 1898-99 | 4,152,173 | 587,823 | 45,153 | 4,785,149 |
| 1899-1900 | 4,286,147 | 647,199 | 50,926 | 4,984,272 |
| 1900-1 | 4,449,546 | 692,486 | 49,013 | 5,191,045 |
| 1901-2 | 4,529,659 | 683,691 | 54,830 | 5,268,180 |
| 1902-3 | 4,694,847 | 696,898 | 59,944 | 5,451,689 |
| 1903-4 | 4,732,142 | 599,727 | 56,857 | 5,388,726 |
| 1904-5 | 4,858,860 | 551,855 | 50,938 | 5,461,658 |
| 1905-6 | 5,036,295 | 575,689 | 51,445 | 5,663,429 |
| 1906-7 | 5,361,227 | 644,701 | 49,357 | 6,055,285 |
| 1907-8 | 5,604,262 | 797,594 | 53,520 | 6,455,376 |

The allowances paid during the year of 1907–8 for alcohol used in the arts and manufactures amounted to £51,014.

From the above it would appear that the concessions granted in 1906 have not greatly stimulated the use of methylated spirits, as the increase since that time is but slightly above the increase in previous years, say in 1903–4 to 1904–5.

The English officials say that manufacturers are expected to use the alcohol denatured with wood alcohol so far as possible, especially since the quantity of this denaturing material has been dropped from 10 to 5 per cent, and "special denaturants" adapted to particular lines of manufacture are not granted except in unusual instances where the wood alcohol can not possibly be used. They have found that it can be used in almost all industries. We did not undertake in England the examination of factories using processes where alcohol is required.

We visited Doctor Thorpe, principal chemist of the government laboratories, who has charge of all the chemical work of the inland revenue board. Doctor Thorpe is not only the technical adviser of the board on all scientific matters, having charge of the chemical examination of all denaturing materials, but is also an authority on the subject of industrial alcohol, having studied it for many years, and having visited Germany in 1905, with Sir Henry Primrose, president of the board of inland revenue, on a special commission to study the development of the use of industrial alcohol there.

Doctor Thorpe does not anticipate any rapid development of the application of alcohol to heat, light, and power purposes in England, on account of the cheapness of petroleum products there. He attributes its increased consumption to the increasing use in manufacturing operations, and to that alone.

Samples of the different grades of mineralized methylated spirits made and sold to the public for general purposes were obtained, together with the methylating materials employed, and these will be examined in the laboratory of the office with a view to further knowledge of the subject, and reported upon at a later date.

## BRIEF STAY IN BELGIUM.

In Brussels our stay was very brief. No provision exists in Belgium for the use of alcohol free of tax for heat, light, or power, but considerable quantities are used in the arts and industries. It was our intention to have visited some of the factories using alcohol, but it was found, upon inquiry through the consul-general, that most of the managers of large establishments were absent on vacation, and the subordinates in charge would not be willing to admit visitors until they could secure full authority, which would take so long that we could not afford to wait. We remained only long enough, therefore, to obtain copies of the most recent official regulations.

### FRENCH SYSTEM OF DENATURING.

In Paris we did not have long to wait for an interview with M. Louis Martin, directeur des contributions indirectes, whom we found extremely courteous and obliging. He answered all our questions concerning the operation of the laws allowing the tax-free use of alcohol in France and supplied us with copies of all regulations adopted for the administration of the same. He said that he greatly regretted that his duties in connection with the preparation of the treasury budget by the legislative committee would prevent his accompanying us personally on a trip to witness the process of denaturing as carried out in France. He detailed as our guide, however, Inspecteur Esgrigny, who made arrangements for us to be present at a denaturing operation as soon as the office had notice of one taking place in an establishment within reach. On August 8, therefore, we visited the denaturing depot of M. F. Dufour, located in Montreuil, in the environs of Paris, but outside the city limits. We found here quite a large establishment, the business being carried out in a substantial building entirely devoted to it, no other occupation being followed by the proprietor than that of denaturer, and wholesale and retail dealer in denatured alcohol.

The officers showed us that the installation of all apparatus and appliances was in strict accordance with the requirements of the Government, all tanks being placed so as to provide for easy access and inspection from all sides, and all pipes and valves arranged to allow of careful control. The operation we were to see was one of "general" denaturing, and consisted in the addition, to 100 volumes of alcohol, of 10 volumes of wood alcohol and one-half volume of coal-tar benzol. The alcohol for denaturing had been made from sugar beets, and was received in bond at the Dufour establishment in metal drums sealed by lead seals. The operation was supervised by three officers, who had been sent for the purpose, upon due notice, from the headquarters of the contributions indirectes service for that district.

The procedure was very similar to that which we saw in England, differing, however, in many details. The facilities for handling the materials were rather more convenient, and the work proceeded somewhat more expeditiously, although there seemed to be an equal amount of care taken in the details of inspection and control. The proprietor stated that there were two grades or qualities of denatured alcohol sold to the public, one being about 90 per cent in strength and the other about 95 per cent. These differed slightly in price, and the weaker spirit was generally used for heat, light, and power, and the stronger for cleaning purposes and as a solvent. Samples of the denaturing materials used in the operation we had just seen, and of the finished product, were kindly furnished by the officers and proprietor, and forwarded to Washington through the office of Consul-General Mason.

We visited also the laboratory of M. Doctor Bordas, directeur des laboratoires des contributions indirectes, and conferred with him concerning various methods of analysis for the detection of small quantities of wood alcohol in presence of grain alcohol, and other matters relating to the discovery of the renaturing and improper use of denatured alcohol. We also questioned him concerning the use of industrial alcohol in France, and especially as to whether its use as a source of energy had increased. Without going into statistics he stated, in a general way, that although the use of denatured alcohol had increased for manufacturing purposes, its use for heat, light, and power had not increased during the past two years and had even fallen off slightly. We had been informed that alcohol was being largely used in Paris for the propulsion of automobiles, and we asked him concerning this. He said that so far as his knowledge went no practical use was being made of alcohol for such purposes. He gave us a card, however, to the proprietor of a large automobile factory who would be able to give us definite information on this point. We visited the factory, but unfortunately found the gentleman away. His secretary assured us, however, that there was no practical use of alcohol in automobiles in Paris, such use as had been made being experimental in character. The results of a recent experiment of this kind, published by the Automobile Club of France, was obtained for us by the consul-general.

We desired and intended to investigate more closely in France the use of alcohol in special lines of manufacture, as the custom prevails there to a considerable degree of using denaturants specially adapted to the particular line of manufacture in which the alcohol is employed, the denaturing being carried out at the factory under the supervision of officers. In the manufacture of chloroform, for example, chloride of lime, which is added in the regular course of manufacture, is used as a denaturing material, the officers making the addition and seeing that the chemical action of this material on the alcohol has progressed sufficiently to destroy it; in other words, they witness the first step of the process. As the study of this subject, however, necessitated obtaining the consent of the manufacturers as well as the consent of the Government to visit the plants, and as this required considerable time, this line of investigation was given up in France, as we were desirous of pushing on to Germany in order to have as much time as possible to investigate the production of alcohol in the agricultural distilleries of that country.

## INVESTIGATIONS IN GERMANY.

We arrived in Berlin August 14 and applied at once to Ambassador Hill's office for an introduction to the proper officials of the German Government. Expecting that considerable time would be occupied in the necessary formalities, we decided to utilize this in a hurried trip to southern Germany for the purpose of making a personal inspection of the small stills used so extensively there in agricultural districts. About 50,000 of such stills are operated in Germany, of which a large majority are located in the provinces of Bavaria and Alsace-Lorraine. We chose Stuttgart as being about in the center of activity in this line, and went to that place. Consul-General Higgins gave us every assistance, and under his guidance we visited several establishments in the environs of Stuttgart. One of these, the distillery of Herr Jacoby, was in full operation, producing the distilled beverage "kirsch" by the fermentation and distillation of cherries. The plant was capable of producing 150 to 200 liters of spirits a day, or 1,500 to 2,000 liters during the fruit season. It is classed by the Government under the head of "material brennereien," ~~or distilleries using various nonstarchy materials, and also as an~~ "abfindungs brennerei," the tax being paid upon the estimated yield of the material employed. Two revenue officers were there at the time of our visit for the purpose of observing the yield of spirits from the first run on the material in hand, this to be used as a basis for the estimated production. No further control is exercised over the distillery, except that it is of course subject to supervision, and is officially closed and sealed out of season.

The first product of the still contained about 30 per cent of alcohol. This was redistilled, partially rectified, and brought to a strength of about 50 per cent. The liquor is entirely used for beverage purposes, and the proprietor said they were never able to produce enough to supply the demand. As all parties agreed, however, that this and the other establishments near the city were much larger than the plants usually operated in agricultural districts, and as it was our desire to obtain actual personal knowledge of the character of the latter, an expedition was made to the ancient village of Esslingen, about 10 miles from Stuttgart, in the valley of the Neckar. Here we found a "distillery" belonging to a widow who conducted a retail liquor business in her husband's name, and who operated the still on fruit materials she purchased for the purpose. The still was a small, crude affair, made by a local coppersmith, and holding only a few gallons. It was set upon a brick oven, and had a condenser attachment passing through a barrel which was filled with running water during operation. It was not in operation at the time of our visit, but was officially sealed and disconnected. We were assured that this plant, so far as capacity and character were concerned, was typical of the ordinary distillery operated in the fruit and farming regions in that vicinity.

From Consul-General Thackara's report it will be seen that of the 59,862 "abfindungs brennereien" which were in operation in Germany last year there were 49,665 which produced less than half a hectoliter (13.2 gallons) during the whole campaign, 3,957 with a production of from 5 hectoliters (132 gallons) to 1 hectoliter (26.4 gallons), and 2,216 with a production of from 1 to 2 hectoliters (26.4 to 52.8 gallons). The total quantity produced by small farmers from the distillation of the products of their land was less than 1 per cent (more exactly, 0.8 per cent) of the total production, almost a negligible quantity when the total quantity of alcohol produced is considered.

Returning to Stuttgart we stopped in one of the manufacturing suburbs and saw another small plant of about the same capacity as at Esslingen.

### RETURN FROM STUTTGART TO BERLIN.

We returned to Berlin on the 19th and found that unexpected progress had been made in the direction of securing an interview with the German revenue officials, so that on the 20th we met Herr Oberregierungsrath Köhler, direktor der indirekten Stenern for the Prussian Kingdom. After a very satisfactory conference with him, he introduced us to Oberzollrevisor Ladewig, the officer having direct charge of all establishments making or using spirits in Berlin or its vicinity, and arrangements were made with him for a trip to such as could be reached within a driving distance from the city.

### VISIT TO VINEGAR FACTORY.

The first place visited was the vinegar factory of Herr Stein, where we saw the operation of denaturing alcohol with the special denaturing material authorized for this particular line of manufacture, viz, vinegar itself. The alcohol was received in bond, sealed, and the first duty of the two denaturing officers present was to see that the seals were intact and to verify the quantity and strength as taken at the distillery when withdrawn. The alcohol was then run into a mixing tank, and the prescribed quantity of vinegar, previously tested and found to answer the requirements as to strength, was added, and after thorough mixing the denatured alcohol was turned over to the manufacturer. The process followed was the usual oxidation method, the alcohol being percolated through vats filled with shavings, and by contact with the air oxidized to acetic acid. The product had a strength of 6 to 7 per cent of acetic acid. The quantity of alcohol denatured and used for manufacturing vinegar was about 1,500 liters per week.

### OPERATION OF AN INDUSTRIAL DISTILLERY.

The next establishment visited was that of Herr Müller, a "gewerbe" or industrial distillery, which was using Indian corn, maize, imported from the United States, for the production of alcohol and also of pressed yeast. The latter product was considered by the proprietor to be fully as valuable as the former. The fermentation was carried on very rapidly by blowing air into the fermenting tubs,

[illegible]

which hastened the process and enabled a mash to be completely fermented in less than twenty-four hours. The alcohol was rectified into "fine spirit" by further redistillation. The control was of the character known as "verschluss," or closed control, except as to the rectifying operations, which are not under closed control, but a definite allowance for loss is made for all the spirit taken into the rectifying still. The closed control consists in the most careful closure and sealing up of all parts of the distilling apparatus by means of lead seals, all pipes, valves, and openings of every kind, including the overflow cup, being made tight, so that there is no way of getting at the alcohol from the time it passes into the still as fermented mash until it enters the receiving tank as pure alcohol. The last point the stream of alcohol passed before it reached this destination was the "messuhr," or meter (also closed and sealed), which registers accurately the quantity and strength, indicating same on dials, which can be readily seen.

The capacity of the Müller establishment is about 600,000 liters per annum.

### OPERATION OF A BRANDY DISTILLERY.

The next place visited was the brandy distillery of Herr Landman. Here cognac was produced from imported French wines. The proprietor was also allowed to bottle his product in bond, or under government control, and a label, or seal, was placed over the cork of the bottle guaranteeing the character, strength, and age of the contents. This, we were informed, was a comparatively new feature in the administration of the German spirit laws, and was a concession which had been made to cognac distillers to enable them to protect the sale of their product against imitation cognac made from alcohol and flavors. It is a parallel, in a way, of our bottling-in-bond law. The distillery was classed as a "material brennerei," and was operated under closure, although in this it was an exception to most distilleries of its class.

### OPERATION OF AN AGRICULTURAL DISTILLERY.

A visit was next made to the most conveniently located agricultural distillery, viz, at Dahlem, about 10 miles from the center of the city, where a tract of land belonging to the domain of the Kingdom of Prussia is devoted to agricultural purposes pending some future use for government purposes. A distillery is operated as one branch of the "farm," and as the spirit laws are imperial laws, this distillery must be operated in all respects as if it belonged to private parties. At the time of our visit it was unfortunately not in operation, as potatoes only are used as raw material, and the season runs from October 1 until May 15. All the apparatus, therefore, was out of commission and officially sealed. The stills were disconnected, and the fermenting tubs all had paper seals in the bottoms. The system of control was practically the same as in the case of the industrial distillery described above as the Müller establishment; that is to say, the entire operation of distilling was under closure from the time the fermented mash passed into the still until it entered the final receptacle, after passing through the meter and having its quantity and strength registered.

The basis upon which the tax was assessed, however, was quite different, this being based in the agricultural distillery upon the quantity of the mash in gallons.

The plant included apparatus for mashing and slicing the potatoes, separating the skins, cooking the pulp, and mashing with malt. Pure-culture yeast is used for fermenting, and two mashings are made per day. The aim is to use as thick a mash as possible, as the tax is laid upon the bulk gallon. This method of levying tax is intended to promote the improvement of the yield of alcohol from a given quantity of potatoes. Two stills were provided, the beer still and the spirit still, the latter being furnished with a column condenser. The product, crude spirits of a strength of about 92 to 94 per cent, is sold to the "Centrale," or spirit ring, either for rectification to "fine spirit" for beverage or medicinal purposes, or for use without rectification for denaturing and industrial purposes.

This establishment produced last year 51,000 liters (134,649 gallons) of alcohol. This was said to be about the average-sized plant. The cost was stated to be, at a rough estimate, 6,000 marks for the installation, exclusive of the buildings in which it was housed. These were substantial brick buildings.

### VISIT TO AN ESTATE OPERATING THREE AGRICULTURAL DISTILLERIES.

Before leaving we visited one more agricultural distillery in order to verify and extend the observations we had made at Dahlem. In carrying out these instructions we had the good fortune, through the kind offices of Mr. F. von Versen, United States vice-consul at Berlin, to obtain permission to visit the distilleries operated on the estates of the Baroness von Eckhardstein, a personal friend of his, who has no less than three agricultural distilleries on different parts of her extensive properties located within two hours' journey of Berlin.

In company with the vice-consul we went by rail to the growing suburban village of Strausberg, about 20 miles from Berlin, then on a small tram-car line 4 or 5 miles to its terminus, where a carriage met us, and we drove several miles farther into the country to the little farm village of Klosterdorf. This is one of the properties belonging to the baroness, and here she met us and personally conducted us over the distillery located there.

Her entire holdings of land aggregate about 40,000 "morgen," or 10,000 hectares (24,700 acres), and consist of three separate farms, or tracts of land, each with its manor house, barn, and farm buildings, and little group of houses. The three villages are called Klosterdorf, Predikow, and Prötzel. Each place is provided with a superintendent and distiller, the latter being a technical man, trained at the Institut für Gährungs gewerbe in Berlin. The superintendent and head farmers live on the place in the cottages, but the day laborers are mainly imported, most of them coming from Russia for the season. The soil is the thin, loose, sandy loam common to all that part of Germany. The land is laid off and kept in beautiful order, traversed in all directions by splendid roads, bordered with shade trees; all the ground is in a high state of cultivation, with very few waste spots. The potato crop, which was in the ground, and the vines still growing at the time of our visit, occupied about one-sixth of the tillable land. Potatoes constitute one of the crops in the careful system of crop rotation practiced, the other crops being clover, root crops (turnips, beets, etc.), and the various cereals. The potatoes, when dug in the fall, are stored in immense heaps in the open, which are covered with straw and earth to protect them from freezing, and only a fraction of the crop is housed, sufficient to enable the still to run in very cold weather when it would be troublesome to take the potatoes from the piles. The manufacturing season runs from October 1 to May 15. The yield is from 5,000 to 20,000 kilos per hectare (75 to 295 bushels per acre). Special varieties which have been bred to a high content of starch are grown exclusively.

As will be seen, the alcohol distillery is simply one part, though quite an important part, of the farm production. At Klosterdorf the distillery apparatus is housed in one of the series of buildings which really constitute the " barn " of the farm. All these buildings are substantially built of stone and have the appearance of considerable age. They are surrounded by a spacious court or " barnyard " where the crops are brought in from the farm, and the animals unhitched and fed. In one part of the stone barn the still is located, occupying perhaps a sixth part of the whole building, or series of buildings. The boiler plant is placed in a separate small building. The " contingent " is 150,000 liters for the season. The plant has a capacity of 1,000 to 1,200 liters per day (280 to 330 gallons). The potatoes are floated into the building by means of a trough, then carried through a washing machine, then steamed and pulped, and the skins removed. The pulp is then run into the mash tub and malt added. The mash is filled into the fermenting tubs, where pure culture yeast is used for fermenting. The " thick-mash " system is used whereby the tax is determined by the volume of the mash, and consequently a very heavy mash is used. The fermenting room at Klosterdorf is kept very neat and clean, the walls being coated with tar to prevent the access of molds and wild yeast cells. The still is a copper column still and the alcohol produced has a strength of about 92 per cent by volume, or 184° proof. It is all hauled to Strausberg and thence shipped to the "Centrale," or spirit ring. The whole apparatus was officially disconnected and sealed up at the time of our visit, of course. The still was connected with a "messuhr," or meter, for the official gauge, in precisely the same manner as the stills we saw in the city.

The plant requires, when running, a daily supply of 30,000 to 36,000 liters of water (7,900 to 9,500 gallons), which is obtained by means of driven wells. We were informed that these wells had been the source of much trouble and expense on account of the liability of the shifting of the sandy strata through which they are driven, whereby they were sometimes entirely ruined. We could not obtain any close approximation to the cost of the plant, as it was not a new installation, but all parties agreed that it would probably be not less than 50,000 marks ($12,500).

After seeing all parts of the distillery we were conducted to another part of the barn buildings, where a large number of milk cows were housed. We were informed that during the distillery season these cows, together with a number of steers intended for fattening for beef purposes, are fed on the distillery slops. The slops are pumped into an elevated tank and thence distributed throughout the barn by troughs placed in front of the stalls. The owner of an agricultural distillery is obliged to use exclusively potatoes or grain raised on his own farm, and must feed the by-products, slops, etc., and return the manure to his own land.

We questioned the baroness concerning the profits she derived from the distilleries, and she said that, while the "crop" (if we may be allowed to so designate it) of alcohol brings in a fair return, not in excess, however, of the returns from other crops grown upon the same area of ground, it forms a part of the system of cultivation, as a whole, and could not well be dispensed with. By affording another rotation the culture of the potatoes increases the return obtained from the soil with a single fertilization, and provides additional insurance against crop failure by diversifying the crops produced.

After going over the plant at Klosterdorf we drove several miles across the country to Predikow. The contingent of the distillery located at this point is 170,000 liters, so the installation is somewhat larger than at Klosterdorf, where the contingent is 150,000 liters. The plant consumes about 180 centners (350 bushels) of potatoes per day; more than 600 acres were devoted to potato culture on this estate the present year. In all respects except size it is the counterpart of the plant first visited. The machinery was being overhauled and put in good condition for operation against the opening of the season, that time being only a month distant at the time of our visit.

Both distilleries are provided with meters, through which the alcohol passes on its way to the final storage tanks contained in locked rooms. These rooms we could not enter, as we had no revenue officers with us to open them, and the keys are kept in the custody of the local officers. All other parts of the distillery are, of course, accessible to the distillery owners, but as it was out of season at the time of our visit, the stills were disconnected and paper seals were in the bottom of all the fermenting tanks, these being the routine precautions against the unlawful use of the apparatus.

The same arrangements are provided as at Klosterdorf for the utilization of the distillery slops, in the shape of elevated storage tanks, into which the liquid is pumped from the still, and from which it is distributed, by means of pipes and troughs, to the stalls where beef animals are quartered for feeding and fattening during the winter season.

Taking the carriage again, we drove 2 or 3 miles in another direction to Prötzel, which is the home place and residence of the baroness; in addition to the group of cottages of employees which forms the little village, it includes a fine old manor house, with large grounds and park attached.

The spacious grounds and drives about the residence were lighted with large mantel lamps, fed by denatured alcohol. The denaturing is done at the distillery in a denaturing plant there provided solely for the purposes of local supply. The consumption is not very large, its only application being for lighting and cooking purposes in the houses of the proprietress and the employees; there are no internal-combustion engines used, the steam plant at the distillery supplying all the power necessary for the conduct of the farm operations.

The distillery plant at Prötzel is the smallest of the three places, the contingent being 100,000 liters. We were assured that it presented no features that were different in any way from what we had already seen at Klosterdorf and Predikow, and as we had to drive some distance to take the train which would enable us to reach the city that night we were obliged to leave without inspecting the distillery at Prötzel, although we regretted not having seen the denaturing part of the plant.

### OPERATION AND CONTROL OF AN ESTABLISHMENT FOR PREPARING COMPLETELY DENATURED ALCOHOL.

The following day we visited the establishment of the Brennspiritus Gesellschaft located at Tempelhof, in the outskirts of Berlin, near the large field used for army maneuvers. One of the principal branches of this concern is devoted to the preparation and sale of completely denatured alcohol. The alcohol is received in tank cars, having traveled in bond from the distillery. The tank cars are run on a sidetrack alongside the denaturing room and the alcohol pumped directly from the car into the denaturing tanks, where it is gauged, the quantity and strength compared with the gauge taken at the distillery, the required quantity of approved denaturing materials added, the whole thoroughly mixed, and the completely denatured alcohol turned over to the establishment for sale. The entire operation was carried out under official supervision, and the requirements concerning the installation of tanks, locking and sealing of all receptacles when not in operation, careful checking of quantities, etc., were essentially similar in character to those we had seen enforced in England and France. The interesting feature about this establishment was the magnitude of its operations, the alcohol being received, as already stated, in tank cars, and the completely denatured article being put up for sale in all manner of forms and sizes of packages, ranging from a tank car down to a quart bottle. The preferred package for retail sale is a liter bottle of strong green glass, provided with a spring top rubber stopper, sealed with a paper strip, and bearing the concern's trademark on the label, together with the retail price, including the bottle, with a provision for the payment of a rebate, 3 pfennigs, for the return of the bottle.

The bottling room of the establishment, where these packages are prepared, is well equipped with the most approved automatic mechanical appliances for measuring, filling, labeling, etc.

The denaturing operation is supervised by two revenue officers, the denaturer paying a fixed price for their attendance according to the time they are occupied in the work. One peculiarity of the German complete denaturing is that the two materials used, viz, wood alcohol and pyridin bases, are already approved and mixed before they reach the denaturing establishment, having been prepared by manufacturing chemists, who supply the mixture, under official seal, to authorized denaturers. At the Tempelhof establishment the mixture had been purchased from the Chemische Werke Fürstenwalde, and it was supplied in metal drums, closed with official lead seals. This obviates the necessity for the denaturer having the materials chemically tested and officially approved, this duty being thus shifted to the chemical manufacturer.

### AN EDUCATIONAL INSTITUTE.

We visited next the Institut für Gärungsgewerbe und Stärkefabrikation, N. See Strasse, Berlin. This institute is an extensive establishment maintained by the distilling trade for the combined purposes of experiment, instruction, and scientific supervision of the industries concerned. A corps of instructors is provided, giving short courses in the technique of the industries, and carrying on research work on the problems presented from time to time; experts are furnished for solving practical difficulties that arise in manufacturing operations; a technical journal is published, model distilling plants are operated, etc. For the Centrale für Spiritus Verwerthung experiments are carried on here in the testing of appliances for utilizing alcohol, such as lamps, stoves, engines, etc. This is not only for the purpose of determining the merit or demerit of new appliances, but also to see that no device is put forth for sale that has any dangerous features. A stationary engine using denatured alcohol as a fuel furnishes power for operating the miniature distilleries used for purposes of experiment and instruction.

This institute forms one of a group of similar establishments carried on by lines of industry which require for successful operation a high degree of scientific knowledge and skill, the extensive experiment station devoted to the interests of the beet-sugar industry being located directly opposite. These institutions have undoubtedly played a most important part in the high development obtained in Germany within recent years by the industries supporting them.

### RETAIL SALE OF DENATURED ALCOHOL AND OF APPLIANCES FOR USING IT.

In order to see the general character of the appliances that were being made and sold for using denatured alcohol in Germany, we visited Doctor Wittelshöfer, the technical director of the Centrale, and obtained from him a card of introduction to the manager of the sales department, who has charge of the extensive storerooms on Friedrichs strasse, opposite the large railway station, where every variety of utensil for the domestic utilization of alcohol for cooking, heating, and lighting was displayed for sale, both wholesale and retail. Alcohol engines, however, are not sold here. We spent a very interesting afternoon at this place, where every courtesy was extended to us, and an extensive stock of all kind of stoves, lamps, and light appliances was shown us and the utensils operated and explained for our benefit. Completely denatured alcohol is also sold at this warehouse. The price on the day of our visit, August 27, was, for a strength of 90 per cent, 30 pfennigs per liter, equivalent to about 27 cents per gallon; and for a strength of 95 per cent, 33 pfennigs per liter, equivalent to about 30 cents per gallon. A special price was quoted for alcohol denatured for use in internal combustion engines for power purposes, which contains only half as much wood alcohol and pyridin as the completely denatured alcohol sold for domestic purposes, and contains some benzine. This price was 22.5 marks per hectoliter (26.4 gallons), equivalent to about 20.5 cents per gallon. This is not a retail price, it will be observed, being equivalent to our quotation "in barrel lots." Doctor Wittelshöfer assured us that this price was placed very low by the Centrale, in order to compete with gasolene, really below the cost of production, and must inevitably be advanced very shortly.

We also visited the salesroom of Moritz Cohn, jr., 68 Ritterstrasse, Berlin, a large manufacturer of alcohol appliances, who had sold several bills of goods for shipment to the United States. He issues a comprehensive catalogue, has an extensive line of goods on sale, and expressed a desire to extend his trade with the United States.

### DIFFICULTIES ENCOUNTERED IN INVESTIGATING THE USE OF SPECIALLY DENATURED ALCOHOL.

We very much desired to make a closer study of the system of special denaturing in Germany, as carried out at factories, particularly in lines of chemical manufacturing. In making such visits it is necessary to obtain the permission of the proprietors, as the government officials, although themselves entitled to entry, can not take strangers with them without such permission being accorded. Oberrevisor Ladewig accordingly requested the firm of C. A. F. Kahlbaum, S. Schlesischestrasse, 36, large manufacturers of fine chemicals in Berlin, who export extensively to the United States, to allow us to accompany him on a visit to their factory, stating that the purpose of our visit was simply to make a personal examination of the system of denaturing in operation there. The manager replied, however, that he could not grant the permission, as it was the settled policy of the firm to exclude strangers entirely from their factory, on account of various processes they employed, the details of which they did not want to make public. We were much disappointed in this, as the officials did not know of any other concern in Berlin which made use of many different special denaturants.

We visited the factory of the Ost Deutscher Spiritus Fabrik, where specially denatured alcohol is used in the manufacture of ether, and the establishment of R. Eisenmann, O. Mühlenstrasse, 617, where the same line of manufacture was carried on. The special denaturant used is ether itself, which is added in the proportion of 10 liters of the ether to 100 liters of alcohol. The necessary denaturing room, tanks, etc., are provided in much the same manner as in the case of the complete denaturing operation witnessed at the Brennsspiritus Gesellschaft, and the operation is supervised by two officers in the same way. These officers are not stationed permanently at the factory, but come when their services are required to superintend an operation, once or twice a week. The cost of this attendance is about 6 marks per day per officer. All the work connected with the matter, all the approved denaturants used, all the apparatus and instruments required—in fact, the entire expense of the official supervision—must be at the cost of the manufacturer.

We could have had an opportunity to witness the use of a great variety of special denaturants at the factory of E. Merck at Darmstadt, or that of the Chemische Fabrik von Heyden, near Dresden, to both of which concerns we had letters from their branch houses in the United States; but time did not then permit of our making another trip south of Berlin. These factories might also have been visited at the time of our trip to Stuttgart, had it not been necessary to hurry back to Berlin to meet our engagement with the German officials there.

### VISIT TO LABORATORIES OF OFFICIAL CHEMISTS.

Our next visit was paid to the laboratory of Doctor von Buchka, the chief chemical adviser of the imperial minister of finance. He is in charge of the "Technische Prüfungsstelle des Reichsschatzamts," and he prepares all denaturing formulas and the official specifications and methods to be used in testing the materials presented for approval. His laboratory does not do the actual testing of these materials, this work being performed by private chemists (who are, however, sworn officers of the Government). The only actual tests and analyses made by the Government, therefore, are those made for the purpose of checking the work of the private analysts. Even these are not handled by Doctor von Buchka, but by Doctor Sassarath in another laboratory.

We next visited the laboratory of Doctor Sassarath, which is located at the Packhof, or customs bonded warehouse. Doctor Sassarath is the director of the laboratory of the Prussian minister of finance, and also of the "Hauptlehranstalt für Zollbeamten," or school of instruction for tax officials. His work in connection with denatured alcohol is to check the results of the private analysts on denaturing materials, and all samples taken in connection with suspected cases of fraud in the way of renaturing are sent to him. This forms but a small part of the work done in his laboratory. An interesting branch of his work is the course of instruction given to the revenue officers in the Hauptlehranstalt. This was instituted by the present Prussian minister of finance, Baron von Rheinbaben, for the purpose of improving the efficiency of his revenue officers. A lecture room and other necessary facilities are provided and the officials in different parts of the Kingdom are detailed to Berlin at such times and in such numbers as will provide an attendance of convenient size at the lectures given by Doctor Sassarath upon subjects closely related to the work they perform, such as the chemistry of fermentation, brewing, distilling, etc. They are also drilled in simple chemical tests. This instruction doubtless aids greatly in bringing about the high degree of efficiency shown by German revenue officers, who seem to understand the technical and scientific part of the industries they supervise almost as well as the superintendents and operators themselves. We have had frequent occasion to note the scientific knowledge shown by the revenue officers in Germany, and it is unnecessary to call attention to the manifest advantage this knowledge brings to them in the intelligent performance of their official duties of supervision and the discovery and prevention of fraud.

Doctors von Buchka and Sassarath have both expressed to us their opinion that it would be much better for the Government if the entire chemical work in connection with denatured alcohol were done by government chemists in government laboratories, as is the case in England and France. The present system is continued in Germany only because it has been so long in operation that it is difficult to bring about a change.

### VISIT TO LARGE INDUSTRIAL DISTILLERY AT WANDSBEK.

On our way to take the steamer at Bremen for return to America we arranged to stop at Hamburg and visit the large industrial distillery at Wandsbek, which Direktor Köhler, at the conference we had with him at his office in Berlin, had arranged for us to see. The day we left Berlin, therefore, Consul-General Thackara notified Hon. Hugh Pitcairn, consul-general at Hamburg, that we would be at that city the next morning. General Pitcairn very kindly called at our hotel for us in the morning, with Vice-Consul Mummenhoff, whom he assigned to accompany us to the distillery. Wandsbek is a thriving manufacturing city of about 30,000 inhabitants, really a part of Hamburg, being only about 10 to 15 miles from the center of the latter city.

We spent the day at this distillery, and we found it extremely interesting as an example of the class of industrial distilleries, "gewerbeliche brennereien," of which we had seen only one, viz, that of Herr Müller, in Berlin.

The distillery at Wandsbek was very much larger and included a far more extensive range of official control than the one in Berlin. The full name and address of the distillery and the company operating it is the Dampf-Kornbrennerei und Presshefe-Fabriken Actien-Gesellschaft (vormals Heinrich Helbing), Wandsbek, Hamburg. The director, Herr Helbing, made us welcome, and informed us that we could consider the entire establishment at our service for any information that might be desired. Prior notice of our arrival had been sent to the local revenue office by Direktor Köhler, from Berlin, and we were met at the distillery by the two chief inspecting officers of the district. We could not possibly have been treated with greater consideration than was shown us by these officers and the distillery management upon this occasion, as they took us over every branch of the extensive establishment and explained to us every detail in which we expressed interest, both as to the working of the plant and the system of government control. Had time permitted we could very profitably have devoted several days to a closer study of the place. It is one of the largest distilleries in Germany, having a productive capacity of about 200,000 to 300,000 liters of pure alcohol per month (105,000 to 158,000 proof gallons).

The yearly production is about 1,500,000 liters of alcohol and 4,000,000 liters of rectified alcohol, but much of the rectified alcohol is rectified for smaller distilleries. The capital stock of the company is 3,000,000 marks (about $750,000). The principal raw material used is maize, Indian corn, most of which is imported from the United States. When the company exports spirits, it is paid a refund of the duty on the maize, so there is customs supervision at the distillery as well as internal-revenue control. Pressed yeast is produced as well as alcohol, and the former is nearly equal to the latter in value. Aeration of the mash during fermentation is generally practiced. Of the alcohol product about half is rectified and used for beverage or medicinal purposes, and the other half is denatured for industrial use. The denaturing is done in a special warehouse on the premises, though it was said that this was unusual, as distillers do not ordinarily denature alcohol themselves. We did not see the denaturing operation performed, but the installation was similar to that we had seen at the Brennspiritus Gesellschaft in Berlin. The officers in attendance at the distillery supervise the denaturing operations when performed. Only the completely denatured alcohol was prepared, together with the kind intended especially for use in motors, and all sold for local consumption.

In the distillery the various operations of fermenting, distilling, desiccation of residue, etc., we found to be conducted with care and skill, scientific methods prevailing throughout, and the most modern and elaborate machinery and apparatus being employed. The firm carries on, besides, an extensive wine trade, both foreign and domestic, and a separate part of the premises is devoted to this branch of their business. A peculiarity in this connection was the presence of a small still in the wine department, used only for the purpose of recovering alcohol from spoiled wines and such like products. This still had a capacity of 1,200 to 1,500 liters per day, producing a liquor of about 30 per cent alcoholic content at the first operation, and was very similar in every way to the plant we had seen at Herr Jacoby's in Stuttgart, making "kirsch" from cherries. Like the latter, too, it was officially classed as a "material brennerei" and the tax was laid upon the liquor produced as an "abfindungs brennerei," or "estimated capacity" distillery, the class to which belong the numerous small fruit distilleries operated in rural districts in Germany.

The big distillery is, of course, officially classed as a "gewerbe brennerei," and operated as a "verschluss brennerei," the tax being laid upon the actual gauge of the alcohol produced, and all parts of the distilling apparatus being at all times under "verschluss" or official closure and seal. There must be hundreds of the small leaden official seals in this establishment, as every possible opening, valve, pipe, or vent in any part of the apparatus containing alcohol, either as vapor or as liquid, was provided with them. The inspection of these seals must be made daily to see that they are intact, and this forms a considerable part of the routine official control by the revenue officers. The work of what we call gauging, however, is very small in amount, as it is minimized by the use of the "messuhren," or meters, which automatically determine and register the strength and quantity of the spirits flowing from one vessel to another, so that it is only necessary to take their readings at the proper times. There are 10 or 12 of these instruments in different parts of the distillery, but not all of these are government meters, as some are used in the commercial control of certain operations.

In the Wandsbek distillery there are employed altogether from 8 to 10 revenue officers, but this large number is partly due to the customs control. While one or more officers are on duty in some part of the establishment at practically all times, it is due to the complexity of the establishment, as the constant personal attendance of an officer wherever a distillery is in operation is not contemplated in the German system of control. We were informed by the high officials in Berlin that in none of the distilleries operated under German laws, whether large or small, whether classed as agricultural or industrial, whether located in large cities or in farm villages, is there any requirement for the constant attendance of an officer during the operation of any part of the process of the production of spirits. This is the chief point of difference between the German system of revenue supervision and our own. Their reliance is placed upon mechanical, ours upon personal, control. From the time the fermented liquor passes into the still the apparatus is closed to all access, and the alcoholic vapor is guarded by seals until it reaches its final resting place, which is also locked and sealed. The process of distillation is, therefore, actually and literally a "continuous closed process." The distiller can not possibly withdraw any alcohol except by breaking a government seal, neither can the revenue officer get at the alcohol in any other way, though he is, of course, authorized to open locks and seals, but even he can only exercise this right under restrictions; and the mechanical arrangement is such that there is little necessity for opening the apparatus at any point along the path that the alcohol travels en route. The alcohol is withdrawn for use, of course, from the final tank in which it is received and stored, which it reaches only after having passed through the meter and registered itself there.

We were interested in Wandsbek in a liquor called "malton wein," an imitation wine made by fermenting a malt mash with wine yeasts. The product resembles different sweet wines in flavor—port, sherry, tokay, etc.—according to the kind of yeast used. We had seen the product before, in fact it had been submitted to our own internal-revenue office for decision as to whether it should be considered a wine or a malt liquor, but the samples shown us at Wandsbek were better approximations to the genuine wines which they imitated than any we had met with. We were told, however, that there was not much sale for the product in Germany. Unfortunately we failed to inquire as to how the article was treated from the standpoint of tax liability.

### THE GERMAN SYSTEM OF SPIRIT TAXATION AND CONTROL.

The last day of our stay in Berlin we devoted to confirming, by means of final visits to officials, such information as we had obtained concerning the German spirit laws and their operation. The system of taxing distilled spirits in Germany is so complicated and difficult that a considerable length of time would be required to fully understand it in all details, especially in its economic aspects. By reason of our visit, however, together with the study we have made of the laws and regulations now in force there, we have obtained a fair knowledge of the subject, especially as to the operations of these laws in reference to the tax-free use of alcohol in the arts and industries. We have embodied our conclusions concerning this phase of the matter in five general propositions, as follows:

The operation of the German system favors—

1. The agricultural class of distilleries working in rural districts, and returning all by-products to the soil, at the expense of the industrial or commercial distilleries.
2. The distillers using potatoes as a raw material, at the expense of distillers using other materials, such as molasses, sugar beets, etc.
3. The small distillers at the expense of the large distillers.
4. The production of industrial alcohol at the expense of beverage alcohol.
5. The producers and users of industrial alcohol by the payment of a large part of the expenses of the supervision incident to this mode of consumption.

We had another interview with Oberrevisor Ladewig, and after going over the subject in a general way to test the accuracy of our information, we asked his judgment, specifically, as to the correctness of each one of the conclusions we had formulated. He confirmed them definitely and positively in every case. We pursued the same plan with Doctor Wittelshöfer, the technical representative of the Centrale, and with the same result. The propositions laid down may therefore be taken as substantially correct without going minutely into the evidence upon which they are based. It may not be considered superfluous, however, especially as Germany has been held up so often as a model of accomplishment in the way of the use of alcohol in the arts and manufactures, to give a general idea of the workings of the elaborate system in operation there in order to better understand why and how the results are brought about.

### SIMILAR TO GOVERNMENT PROMOTION OF BEET-SUGAR INDUSTRY.

The promotion of the industrial use of alcohol is only one part of a comprehensive paternalistic system of internal development and soil improvement, somewhat akin in its methods and purposes to the system of encouragement extended to the beet-sugar industry in Germany for so many years, which not only brought about the establishment of an entirely new and most profitable line of manufacture, but also added another important crop to diversify agricultural production and at the same time contributed greatly toward the enhancement of the fertility of the soil. In the case of the sugar beet a consumption tax was laid upon sugar, which tax was refunded upon exportation with certain additions, constituting practically an export bounty. An increased yield of sugar from the beet was stimulated by assessing the tax upon the weight of beets manufactured into sugar; and the use of the beet pulp for cattle-feeding purposes and of the scums, etc., for fertilizing material, brought about the benefit to the soil.

In the case of potato alcohol the preferential bounty arises by reason of the remittance of certain fractions of the graduated taxes laid upon alcohol; the stimulus of yield is brought about by assessing tax upon the volume of the mash; the utilization of the slops for feeding, and the refuse by-products for fertilizer purposes results in a return to the land of all the essential elements of fertility taken from it by the crops.

The overproduction, which was one of the ill results brought about during the operation of the sugar bounty, however, is prevented and controlled, to a measure, in respect of alcohol production, by the expedient of the "contingent," or limit placed upon the quantity produced by each distiller which is entitled to the maximum bounty. As soon as he exceeds his contingent, a considerable proportion of the bounty ceases, and is not paid on the balance of his production.

The stimulus to production, therefore, is self-limited, and is operative only to the extent of the estimated degree of the calculated contingent. By the same device, if it may be thus designated, the small distiller is favored over the large distiller, as there is no inducement for increasing the capacity of a distilling plant to a point in excess of its contingent.

The discrimination in favor of potato alcohol, as against alcohol produced from sugar beets or beet molasses, results from the exclusion of distilleries using the latter materials from classification as agricultural distilleries, thus throwing them into the "industrial" class, which does not participate in the benefits of the bounty to the same extent.

We have used the term "potato alcohol" for the sake of brevity, to designate the product favored by the bounty system; the alcohol produced from home-grown grain in agricultural distilleries, under the same conditions, enjoys the same benefits as that produced from home-grown potatoes; but the potato product exceeds the grain product in quantity ten to one, consequently that crop is the chief beneficiary.

The preference for the potato crop doubtless arises, not because it furnishes a cheaper or better raw material for manufacturing purposes, but mainly because of its agricultural advantages as a root crop rotation.

### RÔLE PLAYED BY THE CENTRALE.

No account of the German system of alcohol production and utilization, however brief, can afford to omit some reference to the rôle played by the "Verein der Spiritus-Fabrikanten in Deutschland" and its executive organization, the "Centrale für Spiritus Verwerthung." While the latter is a private and not a government agency, it operates in harmony with governmental aims and policies, and contributes greatly to the successful and smooth operation of the general system.

The Centrale has control of over 90 per cent of the entire spirit production of the Empire, and acts as a middleman between producers and consumers. The producer must sell to the Centrale, and the user, either of beverage or industrial alcohol, must buy his supplies from the same organization. The monopoly is intended to be a beneficial one, administered with due regard to the tripartite interests, the producer, the consumer, and the Government. The commercial advantages of its operation are, of course, those incident to a large trade monopoly in any commodity, and are plainly apparent; it brings about economy in handling the product, uniformity of price to both buyer and seller, elimination of middleman's profits, etc. That the distribution of benefits secured by the system is not by any means satisfactory to all parties concerned, however, was sufficiently evident by several leading articles appearing in various influential journals at the time of our visit in Germany, some of which complained very bitterly of the injustice which resulted to certain interests by the operation of the spirit-tax laws. The most convincing evidence of dissatisfaction with the system as it stands, however, comes to hand just as we are writing this report, in the shape of a cable dispatch from London to the Oil, Paint, and Drug Reporter, of New York, a leading trade journal, a copy of which is appended to this report. It will be necessary to confirm this news item and obtain the full text of the proposed legislation before intelligent comment is made concerning it. It would appear, however, that the German Government's proposal is to take upon itself the functions now performed by the Centrale, thus creating a government monopoly in the product, so far as concerns its sale and distribution. The aim is, doubtless, to accomplish a more equitable distribution of benefits between producers and consumers than prevails under the present system, and at the same time secure a larger revenue from spirit sources.

### STATISTICS OF SPIRIT PRODUCTION AND USE IN GERMANY.

We have endeavored to describe, briefly, the salient features of the system of spirit taxation and control in operation in the German Empire. The excellent résumé of the statistics of the subject contained in Consul-General Thackara's report obviates the necessity for us to make a further study of this phase of the matter. We had expected, however, to bring his figures up to the end of the campaign year 1907–8, in which we were disappointed by the unaccountable failure of the arrival from Germany of a number of the "Vierteljahresheft des Statistiks des Deutschen Reichs" containing the desired information.

The figures in this report showing the production of alcohol in Germany from all sources and for all purposes, confirmed by our personal observations of the different kinds of apparatus used in the various classes of distilleries, and taken together with the description just given of the general working of the system, demonstrate very conclusively the error of the impression which has obtained very wide credence in America that the producer of alcohol for denaturing purposes in Germany is especially favored in the matter of government control by exemption from many of the restrictions thrown around the producer of beverage alcohol, and that the great development of the use of denatured alcohol there was primarily due to this fact. This erroneous belief was even shared by our own office, as shown by the following, quoted from page 7 of the annual report for the fiscal year ended June 30, 1907:

> It also appears that under this system there are some 70,000 farm distilleries producing industrial alcohol, and that the alcohol so produced is sold to consumers at about 27 cents per gallon.

In point of fact it is shown by Consul-General Thackara's report that of the 65,405 distilleries in actual operation in Germany during the campaign year 1906–7, 50,316 were "material brennereien," using nonstarchy material, fruits, berries, wine lees, etc., and producing not industrial alcohol, but potable distilled spirits, brandy, kirsch, etc. These distillers could not dispose of their product as industrial alcohol if they wished to do so, because it is not high enough in alcoholic strength to use for burning, and if they could they would not desire to do so, as they can obtain a much higher price for it in the shape of potable spirits.

One reason for the mistake of supposing that the product of these numerous stills is used as industrial alcohol may be found in the fact that the German official statistics state all distilled spirits in terms of pure alcohol, regardless of the strength at which they are produced and sold.

This class of distilleries, although great in numbers, produces less than one per centum of the total alcohol consumed in Germany. They are favored in the system of government control just as fruit brandy distilleries are in this country by a less rigid inspection, but they have absolutely nothing whatever to do with the question of denatured alcohol. The important factor in this connection is the class of "landwirthschaftliche brennereien." Of these there were in operation during the campaign year of 1906–7, 13,837, of which 5,871 used potatoes as raw material and 7,966 used various kinds of grain. These produced, in round numbers, 86,000,000 gallons out of a total production of 101,000,000 gallons, of which 78,000,000 gallons were made from potatoes. Therefore more than 85 per cent of all the alcohol produced in Germany is made in these agricultural distilleries, comparatively few in number. Not only is most of the alcohol made by them used for industrial purposes, but most of the beverage and medicinal alcohol as well. They are all fairly good-sized plants, capable of producing high-proof alcohol in continuous process, and with a capacity of from 300 to 900 liters of such alcohol (120 to 300 gallons proof spirit) per day. So far as immediate official control is concerned, they are not favored in any way over the industrial distilleries; the supervision is just as careful and close, and costs the same in both cases. They are, however, favored in a fiscal way, their product paying less tax. Along with this concession goes the limitation of their output by the "contingent," and the requirements for the return of by-products to the soil.

### GERMAN SYSTEM NOT APPLICABLE TO THE UNITED STATES.

From the foregoing it must be plainly evident to anyone that neither the whole nor any fundamental feature of the German system for fostering the production and use of industrial alcohol could be adopted in this country under the present laws; it would require a complete change in the laws for the collection of tax upon distilled spirits and the introduction of discriminating and graduated taxes upon spirits produced under differing conditions. If Congress supposed that in the enactment of section 4 of the amendatory act of March 2, 1907, it was approximating the German system in any important particular, it singularly erred. The character of alcohol legislation embodied in this section, whereby a separate and distinct class is created of distilleries producing alcohol solely for denaturing purposes is, contrary to general belief, unique of its kind, and does not find a counterpart, so far as we are aware, in the laws of any other country than our own. The German laws do not provide for any relaxation of official supervision in the case of distilleries producing alcohol for industrial purposes; per contra, our law does not afford the farm distillery any of the material advantages which it enjoys under German laws. The absence of official "red tape" may contribute considerably to the convenience of the farmer who undertakes the distillation of alcohol from his products, but it will not materially cheapen the cost of production. And it is our firm belief that the use of alcohol as a source of energy, whether it is made in farm distilleries or in trade distilleries, large or small, will never make rapid progress in this country in the face of the cheap competition of petroleum products until the cost of production is materially diminished. With denatured alcohol priced, as it is to-day in the New York market, at 46 cents per gallon, while benzine is priced at 19 and kerosene at 14 cents, the economic disadvantages with which the first-named product has to contend are sufficiently obvious.

### FISCAL AID TO THE PRODUCTION OF INDUSTRIAL ALCOHOL.

The best way of aiding it in this unequal struggle—the most simple, decent, and straightforward method under our system of taxation—is by a direct bounty paid upon every gallon used for industrial purposes. Ample precedent exists for this in the bounty paid upon home-grown sugar from 1890 to 1894. Like sugar, it is an agricultural product which not only takes nothing from the soil, but greatly contributes to its fertility. Unlike the sugar industry, the alcohol industry is already a subject of governmental supervision, and must, in the nature of things, always remain so; the machinery for the payment of a bounty on alcohol already exists, and it would not require the inauguration of an extensive new control, as was the case with the sugar bounty. Moreover, the producer of industrial alcohol has a very real and actual claim for subvention to the extent of the cost of supervision to which he is obliged to submit because he is unfortunate enough to produce an article subject to tax when used for other purposes. This is the sole basis of the English surtax, or allowance, of 3d. per proof gallon now paid upon all alcohol used industrially, and which is not considered as a bounty, but as an equalizing allowance.

### RECOMMENDATIONS.

While the German system of spirit-tax supervision, as has been shown, is wholly incapable of adaptation to our laws and conditions, our study of it has suggested several points wherein our system may be modified to advantage, and the changes contribute greatly to its future development.

### CAPACITY OF THE DISTILLERIES AUTHORIZED BY THE AMENDATORY ACT.

First, in regard to the capacity of the distilleries authorized by section 4 of the amendatory act, it is evident that the limit of capacity, viz, 100 proof gallons per day, is placed at too low a figure in the law. It is apparent that both the Ways and Means Committee in reporting the bill, and Mr. Yerkes in his approval of the same, were unaware of the size of the distilleries that actually produce the industrial alcohol of Germany (frequent allusions in their report show that they had German stills in mind). There are but very few of these that do not have a greater capacity than 100 proof gallons per day, and the average is almost double this figure.

For use as a source of energy alcohol must have a strength of not less than 90 per cent by volume; and for many industrial purposes, where it is used as a solvent, it must be still higher—90 or 95 per cent. For the production of alcohol of this strength a still provided with a fractionating apparatus or "column," which enables it to turn out alcohol of high strength by continuous process, is absolutely essential, for the *economical* manufacture of such spirits, at least. The simple pot still, which serves very well the purposes of the fruit distiller for producing beverage spirits, even in considerable quantities, is entirely inadequate to the production of high-proof spirits. By repeating the process of distillation, of course, it is possible to bring the distillate finally to a strength of perhaps 90 per cent; but every redistillation doubles the cost of the process, the time required for manufacture, and the loss of alcohol. The fractionating column turns out the alcohol at from 92 to 95 per cent at one operation at a minimum of cost, of time, and of waste of material. The installation of any kind of a fractionating still is expensive, however, even the smallest, as the apparatus must be constructed of copper, and is not justified for a plant of small capacity.

Like other lines of manufacture, the larger the plant, the cheaper is the cost of operation, within limits, relative to the quantity of product; the expense of superintendence, labor, and even of power is but little more for a large plant than for a small one. It is very doubtful, therefore, if a column still can be advantageously installed and operated at a capacity much below 100 proof gallons per day, and without anticipating in any way the results of the experiments carried out in the Department of Agriculture this year, we would state that we are very confident that they will point to the same conclusion.

We would respectfully recommend, therefore, that Congress be asked to raise the limit of daily production imposed upon the industrial alcohol producing distilleries in the amendatory act from 100 proof gallons to at least 200 proof gallons, and probably 300 proof gallons would not be too high for the liberal encouragement of this class of distilleries.

The regulations could readily be arranged to provide for a more careful supervision of the larger establishments, so as to cover the contingency of wider opportunities for fraud.

### USE OF DENATURED ALCOHOL FOR MANUFACTURING PURPOSES.

In the matter of the use of denatured alcohol for manufacturing purposes we have already pointed out the difficulties we encountered. Manufacturers in any line of industry in Europe are rather reluctant to open their establishments to visitors, especially to persons who may have some knowledge of the processes carried on therein; but even when such courtesies are freely extended it requires time to secure the necessary permission. It must be secured from principals in all cases, as subordinates invariably refuse to take the responsibility of admitting a stranger, even if it is impossible for any reason to communicate with the principals.

The hurried character of our trip, therefore, and the fact that it was made during the summer vacation season, both operated against an adequate investigation of this phase of the subject. We have become firmly impressed with the belief, however, that our system of handling the use of specially denatured alcohol in factories will never be fully efficient and up to date until we adopt the practice of denaturing at the factory instead of at the distillery. This is peculiarly true of America, on account of the extent of territory and the consequent long haul to which the materials are subject. The expense involved in shipping a denaturing material from New York to Peoria or New Orleans, and then sending the denatured alcohol containing this material back again to New York before it reaches the factory in which it is used, must greatly enhance the cost to the manufacturer. It involves, also, an elaborate outfit of tanks for different special denaturing materials at the denaturing warehouse, as each formula must be kept by itself and to itself, and the same tanks can not be used for different materials or formulas on account of the danger of contamination. Many difficulties have already arisen concerning the transportation of materials back and forth from the warehouse to the factory, and the range of choice of denaturing materials has been much narrowed, because substances, which were otherwise desirable, such as acids, for example, could not be used, because they attack the containers, or the alcohol itself, during transportation.

The Ways and Means Committee recognized the useless expense involved in shipping denaturing materials back and forth between distillery and factory, but the measure which they adopted for its cure, namely, the provision for the establishment of " central denaturing bonded warehouses " not connected with distilleries, has, like all half-way measures, proved unsatisfactory, at least in the present development of the use of denatured alcohol, since the extent of the business has not been sufficient to induce parties to engage in it solely as methylators or denaturers. It does not seem to justify the establishment of a denaturing warehouse at a factory, as the term used in the act, viz, " central denaturing bonded warehouses " could hardly be applied to a warehouse serving one manufacturer only. We would respectfully recommend, therefore, that Congress be asked to strike out the word " central," in section 2 of the amendatory act. This will do away with all question as to our authority to inaugurate the system of denaturing at factories, and we would suggest that we be permitted to take steps looking to such end. The principal objection raised to this plan by Mr. Yerkes, in his letter to the committee concerning the amendatory act, was that the expense of official supervision would be greatly increased and would have to be borne by the Government. This objection can, and in our opinion, should be met by making a charge against the manufacturer to cover the expense of the necessary attendance when denaturing operations are performed.

This is the universal rule abroad, except that in England, under the amended law of 1906, the charge for attendance of officers has been done away with, unless such attendance is at irregular hours, or to serve the special convenience of the manufacturer. It might be made optional for the manufacturer here to either get his specially denatured alcohol from the distillery, as at present, without charge, or have the denaturing done at his factory with a proper charge for the attendance of the denaturing officers. Presumably the large users of specially denatured alcohol would very gladly bear this charge for the sake of the advantages they would enjoy under a system of factory denaturing. This charge can probably be made and enforced under the law as it stands, though it would doubtless be better, if the law is to be amended in other respects, to ask for the insertion of a provision giving specific authority to the administrative officers to require the reimbursement of the Government for such expenses incident to denaturing as should, in their judgment, be borne by the manufacturers using special denaturants.

## SPECIAL DENATURANTS FOR USE IN THE MANUFACTURES.

Concerning the adoption of fewer or simpler materials as special denaturants for alcohol used in the manufactures, we have no specific recommendations to make. The German system is the most liberal of all in this respect, the additions required being often very small in quantity, and of slight deterrent efficiency, or easily removable. Another liberal feature is the wide range of choice in formulas which is permitted to manufacturers. It must be kept in mind, however, that our conditions are quite different from the conditions in Germany, as the tax is much higher on spirits here than it is there, consequently the inducement to fraud is greater.

In this respect our conditions approximate those of England more closely than those of Germany, and the English system of special denaturants requires the addition of more efficient denaturants than the German, although it is quite elastic and seems to be more a matter of direct arrangement between the individual manufacturer and the internal revenue officials.

No set list of prescribed denaturing formulas is published by the English authorities. They state in their annual report for the year ended March 31, 1907, as follows (p. 39):

> There is good reason to believe that the industrial purposes are relatively few, of which the requirements in respect of alcohol can not be satisfactorily met by the use of "industrial methylated spirit" (denatured by the addition of 5 per cent of approved wood alcohol, our special formula No. 1) and in future it is probable that the cases which will require to be dealt with under section 8 of the finance act, 1902, will not be numerous.

Germany, however, allows of the use in any line of manufacture, on bonded premises, of alcohol denatured either with 5 per cent of wood alcohol alone or one-half per cent of pyridine alone, and provides besides an extensive list of other special denaturants.

Possibly we may be able in the course of time to approximate more closely the liberality of the German system in this respect, nothwithstanding the higher rate of tax laid upon distilled spirits in this country; the temptation to favor the manufacturers in this direction is very strong. Before this is done, however, it is essential that our system of control be strengthened in certain particulars in which it is far behind the German in respect of security. One of these is in the matter of the mechanical contrivances, locks, seals, etc., to protect the alcohol during the processes of manufacture. We have already described the care with which this means of control is established and maintained at all distilleries in Germany; we think we could very advantageously adopt it to some extent in lieu of or in supplement to the feature of personal attendance and control which is so prominent in our system (and very unsatisfactory in its operation in many respects), not only for the control of the manufacturing use of alcohol, where it would be very valuable in connection with the protection of processes of recovery and reuse, but also for the partial or complete control of alcohol production.

Another feature of control which the German officials consider a most important safeguard is what might be called the statistical control of manufacturers; manufacturers are required to keep books and make reports of the quantities of all articles produced from alcohol, or in the manufacturing of which alcohol has been used. This serves as a check upon the misuse of the alcohol, as the officers can readily determine from these reports, within limits, whether the total quantity used in a certain period is in excess of that required for the total quantity of goods manufactured during the same period. This feature does not enter into our system at all, presumably because of the protests it would have encountered on the part of manufacturers. The German manufacturer is careful and precise in the control of his process and exact in accounting for all material; he is accustomed to government supervision and readily submits to a system of inspection under which the American would probably prove very restive, and resent as an intrusion into his private affairs, yet it would probably prove a blessing in disguise in that it would lead him to more exact methods of bookkeeping and to economies in his system of manufacture. Another important element of success in the German control is to be found in the corps of intelligent and well-trained officers which has in hand the execution of the laws and the conduct of the supervision of lines of manufacture wherein alcohol is used, as well as of the distilleries wherein it is produced. The adoption of the means whereby this may be approximated in our own service lies entirely within the domain and discretion of the Department, and does not require the consent or cooperation of any private interest; neither does it demand congressional action.

The need of special knowledge on the part of supervising officers can be readily appreciated when the complexity of the mechanical and chemical processes employed in the many and various lines of manufacture in which alcohol is employed is taken into consideration. Without special knowledge the inspection of these complicated processes is an absolutely worthless safeguard. A hundred ordinary officers might pass through a factory without detecting irregularities which would be patent at once to the eye of an expert. We would respectfully suggest, therefore, the adoption of some system of instruction and training whereby a class of officers of this kind can be developed and maintained in a state of efficiency. It would not be possible to bring internal revenue officers to Washington for training, but they could be assembled in groups in different districts where special work of this kind is required, and met there for a short course of instruction by experts in the service who could be detailed for this duty for certain periods. Examinations or tests of efficiency could be conducted at the same time, which would develop such men as have a special aptitude for work of this kind, and provide an intelligent basis for the building up of this branch of the service.

### USE OF METERS FOR GAUGING SPIRITS.

In closing our report we wish to call attention to the desirability of an investigation into the use of meters for gauging large quantities of spirits, with a view to their adoption for this purpose, if found to be advantageous. One can not fail to be impressed, in going about the distilleries in Europe, with the highly important part played by these instruments in the system of control, both official and commercial; the saving of labor and time, and the attainment of accuracy secured by their use must be very great.

The purpose of our trip and the limited time at our command did not permit us to examine very closely into their use; but all the officers we questioned concerning them assured us unhesitatingly of their accuracy and reliability and seemed to be surprised that we should raise any doubt of their desirability. Meters were adopted for gauging purposes in the United States, to a certain extent, in the early days of the Internal-Revenue Service; we have no personal knowledge of the experience of this office with them, as they were abolished years before we entered the service. We have been informed, however, by officers who were in the service at the time, that they not only proved inaccurate and unsatisfactory in their operation, but that grave scandals arose, in some way, in connection with their purchase or use. The result was, however, to discredit the use of meters as a means of gauging spirits and create a prejudice against them in the minds of internal-revenue officials. As this unfortunate experiment was carried out many years ago, it does not seem rational to suppose that the same difficulties would be encountered at the present day, as the instruments have doubtless been improved and perfected. The office would have now the benefit of the assistance of the National Bureau of Standards, and could doubtless have all instruments tested for accuracy by that office, which is well equipped for such work. It would also have the advantage of the experience of European countries, as the instruments which seem to give such good service and satisfaction there could readily be obtained, and would serve as models for the production of similar instruments by manufacturers in this country.

In conclusion we wish to thank you for the interest you have shown and the support you have given us in all matters connected with the investigation.

Respectfully submitted.

JOHN G. CAPERS,
*Commissioner.*
CHARLES A. CRAMPTON,
*Chief Chemist.*

HON. GEO. B. CORTELYOU,
*Secretary of the Treasury.*

# APPENDIXES.

## No. 1.

[Daily Consular and Trade Reports, Saturday, October 3, 1908. No. 3295.]

## ALCOHOL IN GERMANY.

### MATERIALS USED, PRODUCTION, AND DISTILLING PROCESSES.

In answer to inquiries, Consul-General A. M. Thackara, of Berlin, furnishes the following report on the production of alcohol in Germany:

In Germany alcohol is produced from almost all materials containing carbohydrates, such as potatoes, fruits, including cherries, plums, and other stone fruits, kernel fruits, berries, grapes, currants, raisins, wine, wine lees, fruit and wine cake, rye, barley, wheat, corn, dari or sorghum, etc., but the greater portion is manufactured from potatoes.

During the campaign year just passed the quantities of the principal materials used in the production of spirits were, in metric tons of 2,204.6 pounds, as follows: Potatoes, 2,727,493; barley, 172,201; rye, 103,352; corn and dari, 104,347; other grain, 23,772. Gallons: Cherries, 12,684; plums, 64,368; other stone and kernel fruits, 43,116; berries, 2,927; wine lees, 949,112; wine and fruit cake, 272,207; grape skins, 6,757,190.

### PRODUCTION OF POTATOES.

As there were 2,727,493 tons of potatoes (100,218,204 bushels, of 60 pounds each) consumed in the various distilleries, from which 78,445,157 gallons of alcohol were produced, or 77.3 per cent of the total output—101,473,345 gallons—the following figures concerning the production of potatoes in Germany are interesting:

The potato in Germany has been brought to a high state of perfection by an elaborate scheme of scientific fertilizing and cultivation, organized by the bureau of agriculture, and by continued experiments from year to year, until the whole system of planting, cultivating, and harvesting has been reduced to exact practical methods.

The total area and production of potato culture in this country during the past fifteen years were as follows:

| Year. | Acreage. | Yield. | Yield per acre. |
|---|---|---|---|
| | | *Metric tons.* | *Bushels.* |
| 1896 | 7,543,578 | 32,329,046 | ........... |
| 1901 | 8,200,979 | 48,687,261 | 218¼ |
| 1907 | 8,148,224 | 45,538,299 | 205⅛ |

Of the 1907 crop 42,618,982 tons of potatoes were sound, while 2,919,317 tons, or 6.4 per cent, were diseased or unsound.

### EXCISE LAWS OF GERMANY.

The excise laws and regulations governing the manufacture of alcohol in Germany are elaborate and somewhat difficult to interpret. According to the manner in which the quantity of alcohol subject to tax is measured, the distilleries are divided into two classes:

(1) Verschlussbrennereien are those which are operated always under strict supervision of the excise officials, and the alcohol produced accurately measured and gauged by means of apparatus provided for by law.

(2) Abfindungsbrennereien, distilleries in which the spirit produced is usually estimated at the commencement of the campaign year, according to the declared measurements of the mash tub, or to the declared capacity of the still, or to the estimated amount of material to be used during the year. In distilleries producing over 132 gallons per annum, the amount of material is officially controlled. In this class are included the small farmers who, by the simplest apparatus, distill the products of their farms. After the estimated excise tax is paid, the alcohol may be consumed or sold without further official control.

By the provisions of the excise laws, distilleries are also divided into three classes, according to the material used in the manufacture of alcohol. In general terms the distinctive features of the three divisions are as follows:

(1) Agricultural distilleries (landwirtschaftliche Brennereien) are those which during the entire year use exclusively grain or potatoes grown principally on the owners' farms or on the farm of one or more of the owners, if the distillery belongs to a cooperative society or company of farmers. In all cases the material purchased from other parties must not exceed one-tenth of the total amount used. In addition all the by-products of the agricultural distilleries must be used as fodder for feeding the cattle or as manure for improving the land of the owner or owners.

(2) Material distilleries (materialbrennereien) are those which during the entire year use nonfarinaceous materials, with the exception of molasses, beet root, and beet-root juice, such as berries, fruits, wine lees, grape pressings, etc.

(3) Industrial distilleries (gewerbliche Brennereien) are those which do not come under the classification of either agricultural distilleries or material distilleries—in other words, those which use during the campaign year partly grain, partly potatoes, or partly raw materials mentioned under the head of material distilleries, or partly other farinaceous materials than grain or potatoes or a mixture of farinaceous and nonfarinaceous materials, or those which use beet root.

At the close of the campaign year 1906–7 there were 89,601 distilleries in Germany, of which 5,640 were Verschlussbrennereien, or those operating under the strict supervision of the excise officials; the remainder, 83,960, were Abfindungsbrennereien, or those which paid the taxes upon the estimated amount of alcohol produced.

### MATERIALS USED AND PRODUCTION.

Of the above-mentioned distilleries only 65,405 were in operation during the year 1906–7.

In the following statement are indicated the class of distillery, the number of distilleries of each class, the principal materials used, and the amount of alcohol produced in 1906–7.

| Character. | Number. | Principal material used. | Alcohol production. |
|---|---|---|---|
| | | | *Gallons.* |
| Agricultural | 5,871 | Potatoes | 78,179,270 |
| Do | 7,966 | Grain | 8,129,106 |
| Industrial | 21 | Potatoes | 265,887 |
| Do | 752 | Grain | 11,754,239 |
| Do | 29 | Molasses | 2,354,736 |
| Do | 42 | Various | 8,828 |
| Material | 142 | Grape wine | 126,616 |
| Do | 266 | Brewery wastes | 39,784 |
| Do | 50,316 | Other material | 620,379 |
| Total | 65,405 | | 101,473,345 |

Included in the foregoing were 59,862 "Abfindungs" distilleries, with a production of 2,657,370 gallons, and 673 yeast distilleries, which produced 12,534,968 gallons of alcohol.

The following were the percentages manufactured from the several materials: Potatoes, 77.3; grain, 7.2; grain yeast, 12.4; molasses, 2.3. The quantity of pure spirits, in the shape of alcohol, brandy, etc., produced by the small farmers from the distillation of the products of their lands was only 0.8 per cent, or 790,081 gallons, of the total production, almost a negligible quantity when the total of alcohol produced is considered. Among the 59,862 "Abfindungs" distilleries which were in operation last year there were 49,665 which produced less than 13 gallons each during the whole campaign, 3,957 with a production of from 13 gallons to 26 gallons, and 2,216 with a production of from 26 to 53 gallons. The largest quantity produced by this class of distillery during the period in question was from 13,208 to 15,850 gallons in three different distilleries.

In middle, eastern, and northern Germany the agricultural distilleries are mostly fitted up with modern apparatus, which will produce daily on an average from 72 to 238 gallons of alcohol of from 90° to 92° Tralles, from potatoes or grain. The size of the plant depends upon the extent of the owner's land on which the raw materials are raised. Many of the distilleries are owned by the farmers themselves and worked on their own account, but there are also combinations of smaller farmers, called "Genossenschaften," which are formed for the purpose of erecting a distillery and operating it in mutual interest, using as raw materials the potatoes and grain produced by their members. Few of the farmers' distilleries have rectifying plants, the crude alcohol being usually sold to dealers for rectifying purposes or for denaturization, to be used for fuel or in the industrial arts. During the last campaign year there were 398 of the cooperative agricultural distilleries in Germany, the production of which was 8,336,401 gallons of alcohol.

### HOME EQUIPMENTS.

In southern Germany, Baden, Wurttemberg, and Alsace-Lorraine are to be found a large number of the small farmers mentioned who, with extremely simple apparatus, distill alcohol from their berries and fruits and from the residue from the manufacture of wine and cider. Usually the best of the fruit is more profitably sold in the market, but when the crops are large, the prices low, and profitable sales limited, as was the case this year with plums and several other fruits, these farmers, not being able to handle large quantities in their own stills, send their products to the larger distillers. This was recently done by the Fruit Growers' Association of Ellwangen. The society collected the fruit from its members, had it distilled into alcohol, and divided the proceeds from the sale of the spirits pro rata, thus making the large plum crop to some extent profitable.

In Wurttemberg and the other wine districts, under ordinary conditions, the fruit is either sold or made into wine or cider, the residue from the operations being distilled into alcohol. The apparatus of these small farmers is generally most primitive, often manufactured by the nearest coppersmith. It usually consists of an iron or copper mash kettle, capable of holding from 5 to 13 gallons, under which is the fireplace; from the kettle a pipe leads to a copper worm, mounted in a barrel, through which the water for condensing the vapor runs. The alcohol produced ranges from 40 to 50 degrees Tralles and is almost entirely used for drinking purposes.

There are also ambulant distillers, principally in Baden, Wurttemberg, and Alsace-Lorraine, who go from farm to farm and work up the materials of the farmers. The average price for the rent of their apparatus is 4 marks (95 cents) per day, the renter furnishing the fuel and oil. If there is an assistant, the rate is $1.66, besides board and lodging. During the last campaign year there were 103 of the ambulant distillers in Germany.

For the benefit of those who have asked this consulate-general for information regarding the cost of an average distillery, such as is used in this country, an estimate is forwarded of a complete distilling and rectifying plant which can produce daily in two mashings 53 gallons of alcohol of from 90° to 92° Tralles, or 47 gallons of rectified spirits of from 95° to 96° Tralles.

[The gallon used throughout the foregoing report refers to the American gallon of 231 cubic inches of pure spirits. Estimated cost of distilling and rectifying plant, catalogues of German manufacturers thereof, and addresses of publishers of books on the manufacture of alcohol, are on file in the Bureau of Manufactures.]

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## No. 2.

[Oil, Paint, and Drug Reporter, November 16, 1908, page 16.]

### THE GERMAN SPIRIT MONOPOLY.

LONDON, *November 4, 1908.*

Information is published to-day in London which throws further light on the intentions of the German Government in respect to the spirit industry in the Fatherland. The particulars to hand appear as a special communication from the Berlin correspondent of the Times, and though they are somewhat involved, I glean the following therefrom. The Imperial Government is to have the exclusive right to purchase and sell wholesale, as well as to distil and refine raw spirit. Private persons are to retain the retail sale of spirits supplied by the imperial distilleries, and also to be allowed to make final processes of manufacture. Such private distillers are to receive compensation on the basis of the average cost of manufacture, with certain qualifications, and the future output of each distillery is to be based on the production of the last three years, because "a price which is to cover the cost of production can only be paid by the Empire for an output which is regulated in accordance with the consumption at home." In addition, these private manufacturers are to receive for the next ten years half of the value of the bounty which would normally be payable on the assigned output, and in certain cases where working expenses are high they are to receive further compensation after that period. Special regulations will be issued to compensate manufacturers of proof spirit, and spirit refineries will for three years be conducted as agencies for the Empire. Bonded warehouses will also be taken over by the Government.

This partial state monopoly will be managed by a government head in connection with the imperial chancellory, and there will be an advisory committee of 20 members, consisting of equal quota of nominees of the Government, the federal council, the Reichstag, and the distillers, which council will determine both the purchase and the sale price of spirit. The sale price will be based on a figure which will cover cost of manufacture and establishment charges, etc. It is estimated to yield a net revenue of £11,000,000 in the first decade, and £12,000,000 afterwards, after allowing for the reduction of loan raised for compensation purposes. The increased price to the retailer is put at a maximum of 50 shillings per hectoliter. Trade spirits for heating, lighting, etc., will for the first five years be supplied at a price not exceeding 25 shillings per hectoliter, and are to be retailed in soldered and certified containers of 20, 10, and 1 liter capacity, the Government disclaiming intention of ousting petroleum or benzine from the market.

The proposals have, of course, to be sanctioned by the Reichstag.

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